

# CURRICULUM VITAE

## H. CARLTON (CARL) FITZ, III

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### EDUCATION

1990: Ph.D., Ecology. University of Georgia, Athens, GA.

1979: B.A. with Distinction, Environmental Science. University of Virginia, Charlottesville, VA.

### PROFESSIONAL EXPERIENCE

- 2001 - present: Lead Environmental Scientist, Everglades Division (since 2003, in Hydrologic & Environmental Systems Modeling Department), South Florida Water Management District. Leader in development and application of spatially explicit simulation models (primarily the Everglades Landscape Model) for integrated ecological assessment of Everglades restoration.
- 1996 - 2001: Senior Environmental Scientist, Everglades Systems Research Division, South Florida Water Management District. Principal developer and analyst of the spatially explicit Everglades Landscape Model for integrated ecological assessment of Everglades restoration.
- 1993 - 1996: Assistant Research Scientist, Institute for Ecological Economics, Center for Environmental and Estuarine Studies, University of Maryland. Team leader in development of spatially explicit simulation models (incl. Everglades Landscape Model) for regional scale ecological research and management.
- 1991 - 1993: Postdoctoral Research Associate, Chesapeake Biological Laboratory, Center for Environmental and Estuarine Studies, University of Maryland. Developed spatially explicit simulation model for regional scale ecological research and management.
- 1989: Consultant, University of Georgia Marine Institute. Developed interactive FORTRAN computer programs for data management/summary of remotely recorded data.
- 1988: Graduate Research Assistant, University of Georgia. Responsible for research project which investigated recruitment patterns of postlarval brachyuran crabs.
- 1987 - 1988: Graduate Teaching Assistant, University of Georgia. Taught introductory biology laboratory course.
- 1984 - 1987: Graduate Research Assistant, University of Georgia. Responsible for research program on blue crabs (*Callinectes sapidus*) within a model-based, ecosystem-level perspective. Hired and supervised one technician.
- 1982 - 1984: Graduate Research Assistant (non-teaching), University of Georgia.

- 1982: Consultant, Eastern Caribbean Natural Area Management Program. Assisted in surveying coral reef, seagrass and mangrove habitats for a prospective National Marine Park in the British Virgin Islands.
- 1980 - 1982: Environmental Research Technician I, Division of Natural Resources Management, Department of Conservation and Cultural Affairs, U.S. Virgin Islands Government. Assisted in multi-disciplinary monitoring and basic research projects in coral reef, seagrass, and mangrove systems.

## PUBLICATIONS

### *In preparation*

- Fitz, H.C., E.E. Gaiser, G.B. Noe (tentative list). *in prep.* The importance of phosphorus loading and accumulation to Everglades ecosystem dynamics.

### *Submitted*

- Fitz, H.C. *submitted.* Ecological models: Wetlands. *Invited article in:* S.V. Jorgensen (Editor-in-Chief), Encyclopedia of Ecology. Elsevier, Oxford, UK.

### *Refereed*

- Voinov, A., C. Fitz, R. Boumans, R. Costanza. 2004. Modular ecosystem modeling. *Environmental Modelling & Software* 19: 285-304.
- Fitz, H.C., F.H. Sklar, A.A. Voinov, T. Waring, R. Costanza, and T. Maxwell. 2004. Development and application of the Everglades Landscape Model. *In:* R. Costanza and A.A. Voinov (Eds.), *Landscape Simulation Modeling: A Spatially Explicit, Dynamic Approach*. Springer-Verlag, New York, NY. pp. 143-171.
- Villa, F., A.A. Voinov, H.C. Fitz, and R. Costanza. 2004. Calibration of large spatial models: a multi-stage, multi-objective optimization technique. *In:* R. Costanza and A.A. Voinov (Eds.), *Landscape Simulation Modeling: A Spatially Explicit, Dynamic Approach*. Springer-Verlag, New York, NY. pp. 77-116.
- Voinov, A.A., H.C. Fitz, R.M.J. Boumans, and R. Costanza. 2004. Modular Ecosystem Modeling. *In:* R. Costanza and A.A. Voinov (Eds.), *Landscape Simulation Modeling: A Spatially Explicit, Dynamic Approach*. Springer-Verlag, New York, NY. pp. 43-76.
- Voinov, A., C. Fitz, T. Maxwell, R. Boumans, R. Costanza. 2002. Modular Ecosystem Modelling. *In:* A. Jakeman, A. Rizzoli (Eds.), *Integrated Assessment and Decision Support*. Proceedings of IEMSS 2002 Conference, 24-27 June 2002, Lugano, Switzerland. pp. 263-268.
- Sklar, F.H., H.C. Fitz, Y. Wu, R. Van Zee, and C. McVoy. 2001. The design of ecological landscape models for Everglades restoration. *Ecological Economics* 37: 379-401.
- Sklar, F.H., C. McVoy, M. Darwish, S. Davis, C. Fitz, D. Gawlik, S. Miao, M. Korvela, C. Madden, I. Mendelssohn, S. Newman, J. Ogden, J. Otero, R. Shuford, and S. Smith. 2001. Hydrologic needs: The effects of altered hydrology on the Everglades. *In:* G. Redfield (Ed.), *Everglades Consolidated Report*. South Florida Water Management District, West Palm Beach, FL, pp. 2-1 – 2-68.

- Fitz, H.C., and F.H. Sklar. 1999. Ecosystem analysis of phosphorus impacts and altered hydrology in the Everglades: a landscape modeling approach. *In*: K. R. Reddy, G. A. O'Connor, and C. L. Schelske (Eds.), *Phosphorus Biogeochemistry in Subtropical Ecosystems*. Lewis Publishers, Boca Raton, FL. pp. 585-620.
- McCormick, P., S. Newman, S. Miao, R. Reddy, D. Gawlik, C. Fitz, T. Fontaine, and D. Marley. 1999. Ecological needs of the Everglades. *In*: G. Redfield (Ed.), *Everglades Interim Report*. South Florida Water Management District, West Palm Beach, FL, pp. 3-1 – 3-66.
- Sklar, F.H., C. McVoy, R. Van Zee, D. Gawlik, D. Swift, W. Park, C. Fitz, Y. Wu, D. Rudnick, T. Fontaine, S. Miao, A. Ferriter, S. Krupa, T. Armentano, K. Tarboton, K. Rutchey, Q. Dong, and S. Newman. 1999. Hydrologic needs: The effects of altered hydrology on the Everglades. *In*: G. Redfield (Ed.), *Everglades Interim Report*. South Florida Water Management District, West Palm Beach, FL, pp. 2-1 – 2-70.
- Wu, J., H. Huang, H.C. Fitz, Y. Wu, and F.H. Sklar. 1998. A new domain partition scheme for the Everglades Landscape Model. *International Journal of Computers and Applications*, 20:137-146.
- Voinov, A. A., H.C. Fitz, and R. Costanza. 1998. Surface water flow in landscape models: 1. Everglades case study. *Ecological Modelling*. 108: 131-144.
- Fitz, H.C., E.B. DeBellevue, R. Costanza, R. Boumans, T. Maxwell, L. Wainger, and F.H. Sklar. 1996. Development of a general ecosystem model for a range of scales and ecosystems. *Ecological Modelling* 88: 263-295.
- Fitz, H.C., and R.G. Wiegert. 1992. Local population dynamics of estuarine blue crabs: abundance, recruitment and loss. *Marine Ecology Progress Series* 87:23-40.
- Fitz, H.C., and R.G. Wiegert. 1991. Utilization of the intertidal zone of a salt marsh by the blue crab, *Callinectes sapidus*: density, return frequency, and feeding habits. *Marine Ecology Progress Series* 76:249-260.
- Fitz, H.C., and R.G. Wiegert. 1991. Tagging juvenile blue crabs, *Callinectes sapidus*, with microwire tags: retention, survival and growth through multiple molts. *Journal of Crustacean Biology* 11:229-235.
- Fitz, H.C. 1990. The utilization of a salt marsh estuary by the blue crab, *Callinectes sapidus*. Dissertation. University of Georgia, Athens, Georgia. 191 pages.
- Rogers, C.S., H.C. Fitz, M. Gilnack, J. Beets, and J. Hardin. 1984. Scleractinian coral recruitment patterns at Salt River submarine canyon, St. Croix, U.S. Virgin Islands. *Coral Reefs* 3:69-86.
- Fitz, H.C., M.L. Reaka, E. Bermingham, and N.G. Wolf. 1983. Coral recruitment at moderate depths: the influence of grazing. *In*: M.L. Reaka (Ed.), *The Ecology of Deep and Shallow Coral Reefs*. Symposia Series for Undersea Research, Volume 1. NOAA Undersea Research Program, Rockville, Maryland, USA. pp. 89-96.
- Rogers, C.S., M. Gilnack, and H.C. Fitz. 1983. Monitoring of coral reefs with linear transects: a study of storm damage. *Journal of Experimental Marine Biology and Ecology* 66:285-300.

### **Technical Reports**

- Fitz, H.C., and B. Trimble. *in preparation*. Documentation of the Everglades Landscape Model: ELM v2.5. South Florida Water Management District.
- Fitz, H.C., and B. Trimble. 2005. Documentation of the Everglades Landscape Model: ELM v2.4. South Florida Water Management District. 434 pp. May 4, 2005.
- Everglades Landscape Model Developers. 2002. Calibration performance of ELM v2.1a: 1979-1995 water quality and hydrology. South Florida Water Management District.  
[http://www.sfwmd.gov/org/wrp/elm/results/cal\\_ver/elm2.1/ELMcalibAnalysis\\_draft.pdf](http://www.sfwmd.gov/org/wrp/elm/results/cal_ver/elm2.1/ELMcalibAnalysis_draft.pdf)  
 209 pp. Accessed on Nov 15, 2003.
- Fitz, H.C., N. Wang, J. Godin, F.H. Sklar, B. Trimble, K. Rutchey. 2002. Agency/public review of ELM v2.1a: ELM developers' response to reviews. South Florida Water Management District.  
[http://www.sfwmd.gov/org/wrp/elm/news/graphics/ELMreviewResponse\\_final.pdf](http://www.sfwmd.gov/org/wrp/elm/news/graphics/ELMreviewResponse_final.pdf) 91 pp. Accessed on Nov 15, 2003.
- Fitz, H.C., A. A. Voinov, and R. E. Ulanowicz. 1996. Modeling water column attributes for ATLSS: WatAtt implementation. Report to National Biological Survey, South Florida/Caribbean Research Center, Homestead, FL 33030-0279.
- Costanza, R., H. C. Fitz, T. Maxwell, A. Voinov, H. Voinov, and L. A. Wainger. 1995. Patuxent Landscape Model: Sensitivity Analysis and Nutrient Management Scenarios. Interim Report for U.S. EPA Cooperative Agreement: #CR 821925010. Center for Environmental and Estuarine Studies, University of Maryland, Solomons, MD.
- Fitz, H.C., A. Voinov, and R. Costanza. 1995. The Everglades Landscape Model: Final Report. Report to the South Florida Water Management District, Everglades Research Division.
- Fitz, H.C., A. Voinov, and R. Costanza. 1995. The Everglades Landscape Model: Scenario Testing Report. Report to the South Florida Water Management District, Everglades Research Division. 15 pages.
- Fitz, H.C., A. Voinov, and R. Costanza. 1995. The Everglades Landscape Model: Verification Analysis Report. Report to the South Florida Water Management District, Everglades Research Division. 16 pages.
- Fitz, H.C., A. Voinov, and R. Costanza. 1995. The Everglades Landscape Model: Calibration Analysis Report. Report to the South Florida Water Management District, Everglades Research Division. 13 pages and binary files.
- Fitz, H.C., A. Voinov, and R. Costanza. 1995. The Everglades Landscape Model: Multiscale Sensitivity Analysis. Report to the South Florida Water Management District, Everglades Research Division. 88 pages.
- Fitz, H.C., R. Costanza, and E. Reyes. 1994. The Everglades Landscape Model (ELM): Compilation of Verification Data. Report to the South Florida Water Management District, Everglades Research Division. 2 pages and 57 Mb binary files.

- Fitz, H.C., R. Costanza, and E. Reyes. 1994. The Everglades Landscape Model (ELM): Compilation of Calibration Data. Report to the South Florida Water Management District, Everglades Research Division. 7 pages and 48 Mb binary files.
- Fitz, H.C., R. Costanza, and E. Reyes. 1993. The Everglades Landscape Model (ELM): Summary Report of Task 2, Model Development. Report to the South Florida Water Management District, Everglades Research Division. 109 pages.
- Costanza, R., H.C. Fitz, T. Maxwell, and E. Reyes. 1993. The Everglades Landscape Model (ELM): Canal Routing Considerations. Report to the South Florida Water Management District, Everglades Research Division. 9 pages.
- Costanza, R., H.C. Fitz, T. Maxwell, and E. Reyes. 1993. The Everglades Landscape Model (ELM): Scaling Considerations. Report to the South Florida Water Management District, Everglades Research Division. 18 pages.
- Costanza, R., H.C. Fitz, E. DeBellevue, and E. Reyes. 1993. The Everglades Landscape Model: The Unit Model, GEM v.1.0. Report to the South Florida Water Management District, Everglades Research Division. 6 pages.
- Costanza, R., H.C. Fitz, J.A. Bartholomew, and E. DeBellevue. 1992. The Everglades Landscape Model (ELM): Summary Report of Task 1, Model Feasibility Assessment. Report to the South Florida Water Management District, Everglades Research Division. 118 pages.
- Costanza, R., H.C. Fitz, J.A. Bartholomew, and E. DeBellevue. 1992. The Everglades Landscape Model (ELM): Summary of Workshop II. Report to the South Florida Water Management District, Everglades Research Division. 22 pages.
- Costanza, R., H.C. Fitz, J.A. Bartholomew, and E. DeBellevue. 1992. The Everglades Landscape Model (ELM): Summary of Workshop I. Report to the South Florida Water Management District, Everglades Research Division. 13 pages.
- Rogers, C.S., H.C. Fitz, and M. Gilnack. 1982. Coral reefs, mangroves and seagrass beds of northern Virgin Gorda, British Virgin Islands. A report submitted to the Eastern Caribbean Natural Area Management Program and the British Virgin Islands Government.

## **SYMPOSIA ORGANIZED FOR PROFESSIONAL MEETINGS**

- DeAngelis, D.L., and H.C. Fitz. "Ecological Modeling". April 2003. Session at the 2003 Greater Everglades Ecosystem Restoration Science Conference. Palm Harbor, FL.
- Fitz, H.C. "Watershed Modeling". April 2000. Special Session at the 15<sup>th</sup> Annual Symposium of the International Association for Landscape Ecology. Fort Lauderdale, FL.

## **PRESENTATIONS**

### ***Invited***

- Fitz, H.C., J. Godin, F. Sklar, B. Trimble, and N. Wang. April 2003. Everglades Landscape Model: Advances in integrated ecological assessment. Greater Everglades Ecosystem Restoration Science Conference. Palm Harbor, FL.

- Fitz, H.C., C. Cornwell, T. Waring, M. Darwish, and F.H. Sklar. April 2000. A landscape simulation tool for evaluating ecological responses to altered water and nutrient management in the Everglades region. The 15<sup>th</sup> Annual Symposium of the International Association for Landscape Ecology. Fort Lauderdale, FL.
- Fitz, H.C., and F.H. Sklar. February 2000. Evaluating Florida Everglades restoration using a process-based landscape simulation model. National Academy of Sciences, Committee on Restoration of the Greater Everglades Ecosystem. River Ranch, FL.
- Fitz, H.C., and F.H. Sklar. September 1999. Evaluating Florida Everglades restoration using a process-based landscape simulation model. The 15<sup>th</sup> Biennial International Conference of the Estuarine Research Federation. New Orleans, LA.
- DeAngelis, D.L., and H.C. Fitz. May 1999. Landscape synthesis and ecological modeling: How can we best describe, understand, and predict ecological changes at the landscape levels? South Florida Restoration Science Forum, Boca Raton, FL.
- Fitz, H.C., F.H. Sklar, Y. Wu, A.A. Voinov, T. Maxwell, R. Costanza, and M. Evett. May 1999. Landscape synthesis and ecological modeling: How can the ecological responses to different management alternatives be predicted? South Florida Restoration Science Forum, Boca Raton, FL.
- Fitz, H.C., F.H. Sklar, Y. Wu, A.A. Voinov, T. Maxwell, R. Costanza. March 1999. Evaluating Florida Everglades restoration using a process-based landscape simulation model. The 95<sup>th</sup> Association of American Geographers Annual Meeting. Honolulu, HA.
- Fitz, H.C., R. Costanza, and A.A. Voinov. 1995. A dynamic spatial model as a tool for integrated assessment of the Everglades, USA. SCOPE/UNEP Project on Integrated, Adaptive Ecological Economic Modeling and Assessment. Pantanal region, Brazil.
- Fitz, H.C. May 1993. Development of dynamic spatial simulation models. First IGBP/LOICZ (Land-Ocean Interactions in the Coastal Zone) Core Project Meeting. Raleigh, North Carolina.
- Fitz, H.C. November 1992. Spatial models in estuarine research. NOAA Estuarine Habitat Program Workshop. Gloucester Point, Virginia.
- Fitz, H.C., and R.G. Wiegert. May 1987. Population dynamics of the blue crab, *Callinectes sapidus*, in a Georgia salt marsh as determined by microwire tagging techniques. Portunid Ecology Workshop. Smithsonian Environmental Research Center, Edgewater, Maryland.

### ***Contributed***

- Fitz, H. C. June 2006. Advances in integrated ecological assessment using the Everglades Landscape Model. 2006 Greater Everglades Ecosystem Restoration Science Conference. Lake Buena Vista, FL.
- Fitz, H. C. April 2006. Advances in integrated ecological assessment using the Everglades Landscape Model. The 21<sup>st</sup> Annual Symposium of the International Association for Landscape Ecology. Mission Bay, CA.
- Fitz, H. C., N. Wang, T. Waring and F.H. Sklar. May 2002. Everglades Landscape Model: Integrated assessment of hydrology, biogeochemistry, and biology. 2002 Spring Meeting of the American Geophysical Union. Washington, D.C.

- Fitz, H. C., T. Waring, Y. Wu , F.H. Sklar,. December 2000. Application of the Everglades Landscape Model in restoration initiatives. Greater Everglades Ecosystem Restoration Science Conference. Naples, FL.
- Fitz, H. C., F.H. Sklar, Y. Wu. October 1997. Evaluating Everglades ecosystem dynamics with spatial simulation models. The 14<sup>th</sup> Biennial International Conference of the Estuarine Research Federation. Providence, RI.
- Fitz, H. C., F.H. Sklar, Y. Wu. May 1997. Evaluating Everglades ecosystem dynamics with spatial simulation models. Meeting of the Walt Dineen Society. Miami, FL.
- Fitz, H.C., A.A. Voinov, R. Costanza. August 1996. Multi-scale sensitivity analysis of a dynamic spatial simulation model of the Everglades. Meeting of the Ecological Society of America. Boston, MA.
- Boumans, R.M.J, R. Costanza, H.C. Fitz, T. Maxwell, A. Voinov, H. Voinov, L. A. Wainger. August 1996. Policy Analysis Tool: Integrated Ecological Economic Modeling. The 4<sup>th</sup> Biennial Meeting of the International Society for Ecological Economics. Boston MA.
- Fitz, H.C., R. Costanza, A. Voinov, F. H. Sklar, T. Maxwell, and E. Reyes. August 1995. A dynamic spatial model of the Everglades landscape: a case study towards integrated ecological economic modeling. Tenth International Conference on State of the Art of Ecological Modeling (ISEM '95). Beijing, China.
- Fitz, H.C., A. Voinov, R. Costanza, F. H. Sklar, T. Maxwell, and E. Reyes August 1995. A dynamic spatial model of the Everglades landscape. Forty sixth Annual Meeting of the American Institute of Biological Sciences. San Diego, California.
- Fitz, H.C., E. Reyes, R. Costanza, and F.H. Sklar. October 1994. Landscape modeling in the Everglades. Third Biennial Meeting of The International Society for Ecological Economics, San José, Costa Rica.
- Fitz, H.C., F.H. Sklar, E. Reyes, and R. Costanza. June 1994. Landscape modeling in the Everglades. First International Symposium on Ecosystem Health and Medicine: Integrating Science, Policy and Management. Ottawa, Ontario, Canada.
- Sklar, F.H., and H.C. Fitz. June 1994. Landscape modeling in the Everglades. American Society of Limnology and Oceanography 1994 Meeting. Miami, Florida.
- Sklar, F. H., C. Fitz, Y. Wu, K. Rutchev, and R. Costanza. March 1994. Components of an Everglades Landscape Model (ELM), Part I. Ninth Annual U.S. Landscape Ecology Symposium. Tucson, Arizona.
- Fitz, H.C., F.H. Sklar, E. Reyes, and R. Costanza. March 1994. A dynamic spatial simulation model of the Everglades landscape, Part II. Ninth Annual U.S. Landscape Ecology Symposium. Tucson, Arizona.
- Fitz, H.C. March 1993. Development of dynamic spatial simulation model of the Everglades landscape. Watershed '93: A National Conference on Watershed Management. Alexandria, Virginia.
- Fitz, H.C., and R.G. Wiegert. October 1989. Blue crabs in a Georgia salt marsh: who's there, where they go, and what they eat. Tenth Biennial Estuarine Research Conference. Baltimore, Maryland.

- Fitz, H.C., and R.G. Wiegert. February 1989. Habitat traps as a recruitment sampling device in Georgia salt marshes. 1989 Blue Crab Recruitment Workshop. Virginia Institute of Marine Science, Gloucester Point, Virginia.
- Fitz, H.C., and R.G. Wiegert. May 1988. The utilization of a salt marsh by the blue crab. National Blue Crab Conference. Virginia Beach, Virginia.
- Fitz, H.C., and R.G. Wiegert. October 1987. Population dynamics of the blue crab, *Callinectes sapidus*, in a Georgia salt marsh: mark-recapture using microwire tags. Ninth Biennial International Estuarine Research Conference. New Orleans, Louisiana.
- Fitz, H.C., and R.G. Wiegert. June 1987. Population dynamics of the blue crab, *Callinectes sapidus*, in a Georgia salt marsh as determined by microwire tagging techniques. American Society of Limnology and Oceanography. Madison, Wisconsin.
- Fitz, H.C., and R.G. Wiegert. March 1987. Movements of the blue crab, *Callinectes sapidus*, onto the intertidal salt marsh. Benthic Ecology Meeting. Raleigh, North Carolina.

## GRANTS

- Fitz, H.C., and R. Ulanowicz. 1995 - 1996. Modeling physical attributes of Everglades habitats. National Biological Survey, Everglades National Park Field Station. \$32,394.
- Had a major role in the conceptualization, proposal preparation, data collection, analysis and interpretation of the following:
- Wiegert, R.G. 1988. Recruitment of the blue crab, *Callinectes sapidus*, to a Georgia salt marsh: preliminary investigations. \$10,000.
- Wiegert, R.G. 1984-6; renewal 1986-7. The utilization of a salt marsh by the blue crab, *Callinectes sapidus*. Georgia Sea Grant College Program. \$193,100.

## COURSES TAUGHT

- Statistical and Dynamic Approaches to Ecological Modeling. September 1999. Co-instructor with F. Gillet, D. Bourcard, O. Wildi. IIIe Cycle Romand en Sciences Biologiques. University of Neuchâtel, Switzerland.

## AWARDS

- 1985: Merit award, University of Georgia. \$2,000.
- 1984: Merit award, University of Georgia. \$2,000.
- 1982-85: Three merit, non-teaching Graduate Assistantships, University of Georgia.

## PROFESSIONAL SOCIETIES

- Ecological Society of America
- US Regional Association of the International Association for Landscape Ecology
- American Geophysical Union
- American Association for the Advancement of Science
- Estuarine Research Federation



## **WWWEB**

Landscape modeling in the Florida Everglades (ELM description, documentation, results, and source code/data). <http://my.sfwmd.gov/elm>. Retrieved July 6, 2006 from the World Wide Web.